Proceedings of the Iowa Academy of Science

Volume 19 | Annual Issue Article 21

1912

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NOTES ON HETERANTHERA DUBIA.

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One of the common acquatic plants of our Iowa lakes is *Heteranthera dubia* (Jacq.) MacM. In the lakes of the Okoboji region this form is conspicuous along sheltered shores of suitable depth. While only sparingly present on the more exposed margins of the larger bodies of water it grows luxuriantly in the shallower bays and associated smaller lakes. In waters of appropriate depth considerable areas are often dominated by this form, sometimes to the exclusion of other large plants. During the summer of 1910 many acres of the "long slough" south of Center Lake were occupied almost exclusively by this species. Portions of the upper end of East Okoboji Lake were occupied this past summer by extensive beds of this plant where for a number of years it had developed but scantily owing to the higher water level. The writer desires in this brief article to call attention to the apparently uniform cleistogamy of this plant in such habitats.

In common with other submerged seed-plants that have not developed the habit of pollination beneath the surface of the water this species of Heteranthera is forced to bring its flowers to the air if cross-pollination is to be affected. In favorable habitats the plants may be two or three feet in length and stand nearly erect buoyed up by the water. Under such conditions the plants may never reach the surface of the water even at the end of the growing season. If in shallower water the plants are turned at the tip and lie horizontal near the surface of the water. In this relation the younger portions of the plant which bear the scattered flowers would be in most favorably placed with reference to bringing the flowers to the surface. The plants thrive best however under conditions that permit few, if any, of the flowers to open at the surface of the water.

The flowers are perfect and the tubular perianth is surrounded by a spathe which completely invests the developing blossom. The stigmas, etc., are brought to the air, if at all, by the elongation of the flower, which is sessile and hypogynous. Since the maximum elongation of the slender flower is but three or four centimetres it follows that a plant must be most favorably placed if the flowers open above the water.

The open perianth displays a six parted limb with its slender segments nearly symmetrically arranged, and this has no doubt suggested the common name "water star grass." Within the slender flower are the three stamens, which are not radially disposed and give to the blossom a zygomorphic appearance. The style is long and very slender and bears at its tip a fringe of large glandular hairs. Within are the chambers through which the pollen-tubes make their way to the ovules.

This floral structure, while well adapted to quiet waters of limited depth, seems illy fitted to the average habit of the plant. Owing to the limited length of the flower it can reach the surface only under restricted conditions and those not the most favorable for vegetative growth. The writer has studied

these plants quite carefully in the Okoboji region and was impressed by the uniform flowering habits of the plant at varying depths of submergence. It was noted that whereas the submerged flowers never open they seemed to set seed with perfect regularity. This suggested that the flowers were either cleistogamous or that the embryos develop apogamously.

Numerous dissections of the mature but unopened flowers showed that they were self-pollinated. Within the flower bud scores of pollen grains were found adhering to the stigma, and with a hand lens the pollen tubes could be seen entering its tissues. Further study of these unopen flowers showed that all the pollen in the anther germinates even though but the tip of the stamen comes in contact with the stigmatic hairs. With forceps the whole pollen-mass, consisting of spores and tangled pollen tubes, could be lifted from the anther as a mass. Most of these tubes never reach the stigma but turn and twist in various ways within the anther. Obviously the stimulus to germination is transmitted from the stigma throughout the pollen-mass and to spores that lie even at the opposite end of the pollen-sack.

An abundance of material was collected for more careful study and details may be expected in a later paper. A preliminary study of the sections shows, however, that the pollen tubes reach the ovules so there is no reason for suspecting apogamy.

In this connection it may be recalled that clesitogamy is apparently rare among submerged seed-plants, where, on account of the difficulties in the way of cross-pollination one might expect to find it of common occurrence. On the other hand, there seems among many forms a pronounced tendency away from the bisporangiate to the monosporangiate type of flower. It would appear that the general tendency toward dioecism in so many of the submersed aquatics might be to avoid self-pollination.